Covalent organic polymer functionalized activated carbon: A novel material for water contaminant removal and CO2 capture

Mines, Paul D.; Thirion, Damien; Uthuppu, Basil; Hwang, Yuhoon; Jakobsen, Mogens Havsteen; Andersen, Henrik Rasmus; Yavuz, Cafer T.

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STUDENT POSTER COMPETITION FINALISTS

Hawaii Convention Center, Kamehameha Exhibit Halls I, II & III
■ Tuesday, December 15, 12:00 Noon–2:00pm

Area 1 – Analytical

1	Microfluidic image-processing-based multipoint crystallization analysis. **Aoi Akiyama**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
2	Early detection of anti-asparaginase to significantly increase remission rate in acute lymphoblastic leukemia therapy. **Alexandra Aubé**	New Tools and Methodologies for the Characterization of Biomolecular Interactions (#15)
3	Design and synthesis of a novel chemical crosslinker for protein structure determination. **Kayla Downey**	New Tools and Methodologies for the Characterization of Biomolecular Interactions (#15)
4	Digital microfluidic platform for UV-Vis absorbance spectroelectrochemistry. **Michael Dryden**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
5	One-step modification and structuring of PDMS surfaces and its application in the bench-top fabrication of self-driven microfluidic channels. **Ayodele Fatona**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
6	Optical nanoantenna for bacterial detection. **Maho Fukuda**	New Tools and Methodologies for the Characterization of Biomolecular Interactions (#15)
7	Development of protein concentration system based on pore-size control of molecular sieving gel by thermal-stimulus response. **Yudai Fukushima**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
8	Plasmonic nanoprobes for sensing hydrogen peroxide in living systems. **Xin Gu**	Plasmonic Materials for Chemical Analysis (#450)
9	Microfluidic single cancer cells isolation and analysis device by simple manual operation for cytoscreening of cancer stem cells. **Yuya Hattori**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
10	Asymmetric rhodamine-based fluorescence probes for multicolor in vivo imaging. **Ryu Iwatate**	Novel Analytical Probes for In Vivo Optical Functional Imaging (#115)
11	Novel nanofiber web-based dry electrodes for long-term biopotential monitoring. **Lu Jin**	(Bio-)Chemical / Electrochemical Sensors and Sensing Materials (#417)
12	Biomarkers research involved in salmonid diseases: An approach based on MALDI-MS coupled with data mining techniques. **Xaviera López Cortés**	Bacterial Identification by Mass Spectrometry (#389)
13	On-chip templated biosynthesis of unnatural and natural protein microarrays suitable for surface plasmon resonance imaging. **Gerald Manuel**	New Tools and Methodologies for the Characterization of Biomolecular Interactions (#15)
14	Evaluation of peptide-material interaction by force mapping method with an atomic force microscope. **Masahito Mochizuki**	New Tools and Methodologies for the Characterization of Biomolecular Interactions (#15)
15	Automatic assembly of non-spherical microscale particles using electroosmotic flow in a microfluidic device. **Hiroko Moriyama**	Micro- and Nano-fabricated Analytical Devices for Chemical, Biochemical and Biomedical Platforms (#129)
16	Paper test card for quantifying beta-lactam antibiotics. **Nicholas Myers**	Paper-Based Analytical Devices for Point of Need Measurements (#213)

Area 6 – Agrochemistry, Environmental, and Geochemistry

217	Effects of processing units on secondary metabolites and functional properties of carrot juice processing. **Tingting Ma**	Food Processing: Chemistry, Quality, Safety, Sustainability, and Value-added By-products (#400)
218	Covalent organic polymer functionalized activated carbon: A novel material for water contaminant removal and CO2 capture. **Paul Mines**	Chemistry of Integrated Water Treatment Systems for Halogenated Organics and Long-lived Radionuclides (#454)
219	Chemical ecology of fluorescent compounds in flower pollen. **Shinnosuke Mori**	Chemical Ecology Applied to Sustainable Agriculture (#105)
220	Phytotoxicity and insect antifeedant activity of calamenene and cadinene type sesquiterpenes from camphorweed exudate. **Ryo Morita**	Phytochemicals for Crop Protection: Discovery to Molecular Target (#358)
221	Fast, sensitive technique for real-time, in situ quantification of commonly applied pesticides in the atmosphere using high resolution time-of-flight chemical ionization mass spectrometry. **Trey Murschell**	Application of Mass Spectrometry to Agrochemical Challenges (#72)
222	Availability of woody biomass degraded by mushrooms as ingredient of fermented total mixed ration for feeding dairy cattle. **Naoya Nagatani**	Recycling of Polymeric Materials: Challenges and Perspectives (#36)
223	Pesticide residues and dietary risk assessment of pesticides in fruits and vegetables in Beijing, China from 2012 to 2014. **Canping Pan**	Human Exposure to Environmental Contaminants (#26)
224	Indium separation from lead-smelting dust by chelant-assisted extraction at high pressure and temperature. **Hikaru Sawai**	Agrochemistry, Environmental, and Geochemistry General Posters

Area 7 – Biological

225	Titin-based fluorescent tension sensors reveal the mechanochemistry of focal adhesions. **Kornelia Galior**	Bio/chemical Approaches for Single Cell Biosensing Technologies (#257)
226	Raman imaging of ex vivo bone formation during osteoblast differentiation. **Aya Hashimoto**	Bio/chemical Approaches for Single Cell Biosensing Technologies (#257)
227	Synthetic study of the polymer as multivalent bioprobe (V): Novel approach for lectin detection using combination of the glycocluster effect and FRET in the fluorogenic glycopolymers. **Riho Hayama**	Carbohydrate Recognition in Health and Disease (#342)
228	Overcoming strand inhibition using viscous environments. **Christine He**	The RNA World: From Prebiotic Chemistry to the Emergence of Complexity (#449)
229	Membrane permeability and ion transport across the cell membranes induced by binol-functionalized ion transporters. **Audrey Hébert**	Small Molecule Interactions in Biomembranes (#418)
230	Functional and structural analyses of a c-di-GMP responsive riboswitch. **Saki Inuzuka**	Functional Nucleic Acids: Chemistry, Biology, and Materials Applications (#10)
231	Artificial division of codon boxes to encode nonproteinogenic amino acids along with 20 proteinogenic ones. **Yoshihiko Iwane**	Advances in Peptide and Protein Chemistry (#6)
232	The forgotten heat shock protein, HSP27: The design and synthesis of molecules targeting HSP27 as chemotherapies. **Jessica Kho**	Heat Shock Proteins: The Next Target in the Disease Frontier (#91)
233	Developing novel photoaffinity probes to identify 'readers' of histone modifications. **Xiao-Meng Li**	Frontiers in Chromatin Biology and Chemical Epigenetics/Epigenomics (#151)
234	Influenza virus fusion peptide-induced membrane acyl chain hairpins detected by paramagnetic enhancement of 2H relaxation. **Shuang Liang**	Advances in Biological Solid-State NMR (#120)
235	Altering stability of a transmembrane protein, MsbA, by structural comparison with its thermophilic homolog. **Ka Lu**	Biological General Posters
236	Design and synthesis of peptidic probes for polycomb group proteins upregulated in stem cells and prostate cancer. **Natalia Milosevich**	Frontiers in Chromatin Biology and Chemical Epigenetics/Epigenomics (#151)
237	Genetic response against removal of CO from the blood of mice by an iron(II)porphyrin-cyclodextrin supramolecular complex. **Saika Minegishi**	Homeostasis of Transition Metal Ions in Biological Systems (#47)

Covalent organic polymer functionalized activated carbon: A novel material for water contaminant removal and CO_2 capture

Paul D. Mines[1,2], Damien Thirion[2], Basil Uthuppu[3], Yuhoon Hwang[1], Mogens H. Jakobsen[3], Henrik R. Andersen[1], Cafer T. Yavuz[2]

[1] Department of Environmental Engineering, Technical University of Denmark, Miljøvej, B113, DK-2800 Kgs. Lyngby, Denmark
[2] Graduate School of EEWS, Korea Advanced Institute of Science and Technology, 291 Daehak-ro, Yuseong-gu, Daejeon 305-701, Korea
[3] Department of Micro- and Nanotechnology, Technical University of Denmark, Ørsteds Plads, B345E, DK-2800 Kgs. Lyngby, Denmark

Abstract

Covalent organic polymers (COPs) have emerged as one of the leading advanced materials for environmental applications, such as the capture and recovery of carbon dioxide and the removal of contaminants from polluted water. COPs exhibit many remarkable properties that other leading advanced materials do not all-encompassing possess. Moreover, COPs have proven to be extremely stable in a wide variety of conditions, i.e. extremely high temperatures and boiling water for weeks at a time, which make them ideal for environmental applications; ranging from CO_2 capture and recovery to organic solvent uptake in concentrated streams to metal and organic pollutant adsorption in contaminated waters. However, given the nanoscale structure of these COPs, real-world application has yet remained elusive for these materials. Herein, we report the functionalization of COPs onto the surface of activated carbon granules; through a series of surface modification techniques, followed by the synthesis of a COP "shell" around the carbon granule. Activated carbon, established as one of the cheapest and most effective environmental remediation materials of all time, provides the perfect base material for the attachment of COPs onto a material large enough to be able to be used in a packed-bed column. These columns can then be applied to the exhaust flue gas stream from a power plant or as a flow-through water treatment column. Furthermore, by impregnating nanoscale zero valent iron (nZVI) inside the COP matrix, these columns can subsequently degrade organic contaminants, e.g. halogenated solvents, azo dyes, antibiotics, etc., during the water treatment process. A first of its kind, activated carbon with a COP-functionalized shell provides a robust and regenerate-able material with the durability and versatility for a wide range of environmental applications.